CLAIMS

What is claimed is:

1. A method for symbol synchronization comprising:

performing a windowing function on a received signal to produce a symbol sample;

multiplying the symbol sample and a reference synchronization symbol in the frequency domain to produce a first signal;

determining the sign of the first signal to produce a second signal; and

performing a Fourier transform on the second signal to produce a third signal containing time-shift information to align the received signal.

2. The method of claim 1 wherein the length of the symbol sample is equal to the length of the reference synchronization symbol.

3. The method of claim 1 wherein the windowing function is accomplished by a Hanning windowing function.

4. The method of claim 1 further comprising:

performing a Fourier transform on the symbol sample to transform the symbol sample from the time domain to the frequency domain before it is multiplied with the reference synchronization symbol.

5. The method of claim 1 wherein the first signal comprises real and imaginary frequency components.

6. The method of claim 5 wherein determining the sign of the first signal comprises determining the signs of both the real and imaginary frequency components of the first signal to produce two corresponding signal components which comprise a fourth signal.

7. The method of claim 6 wherein the two components of the fourth signal are convolved to produce the second signal.

8. The method of claim 1 wherein the Fourier transform performed on the second signal is a fast Fourier transform.

9. The method of claim 1 wherein the third signal comprises real and imaginary components.

10. The method of claim 9 further comprising:
adding the real and imaginary components of the third signal together to produce a fifth signal.

11. The method of claim 10 further comprising:
aligning the received signal according to the time-shift indicated by the fifth signal.

12. The method of claim 10 further comprising:
detecting the peak of the fifth signal to determine the time-shift required to align the received signal.

13. The method of claim 12 further comprising:

generating an index based on the location of the detected peak, the index corresponding to the amount by which to time-shift the received signal to synchronize it.

14. The method of claim 12 wherein the magnitude of the peak indicates the direction of the time-shift required to align the received signal.

15. A machine-readable medium having one or more instructions for synchronizing a received signal, which when executed by a processor, causes the processor to perform operations comprising:

performing a windowing function on the received signal to produce a symbol sample;

multiplying the symbol sample and a reference synchronization symbol in the frequency domain to produce a first signal;

determining the sign of the first signal to produce a second signal; and

performing a Fourier transform on the second signal to produce a third signal containing time-shift information to align the received signal.

16. The machine-readable medium of claim 15 wherein the length of the symbol sample is equal to the length of the reference synchronization symbol.

17. The machine-readable medium of claim 15 wherein the windowing is accomplished by a Hanning windowing function.

18. The machine-readable medium of claim 15 further comprising:

performing a Fourier transform on the symbol sample to transform the symbol sample from the time domain to the frequency domain before it is multiplied with the reference synchronization symbol.

19. The machine-readable medium of claim 15 wherein the first signal comprises real and imaginary frequency components.

20. The machine-readable medium of claim 19 wherein determining the sign of the first signal comprises determining the signs of both the real and imaginary frequency components of the first signal to produce two corresponding components which comprise a fourth signal.

21. The machine-readable medium of claim 20 wherein the two components of the fourth signal are convolved to produce the second signal.

22. The machine-readable medium of claim 15 wherein the Fourier transform performed on the second signal is a fast Fourier transform.

23. The machine-readable medium of claim 15 wherein the third signal comprises real and imaginary components.

24. The machine-readable medium of claim 23 further comprising:

adding the real and imaginary components of the third signal together to produce a fifth signal.

25. The machine-readable medium of claim 24 further comprising:

aligning the received signal according to the time-shift indicated by the fifth signal.

26. The machine-readable medium of claim 25 further comprising:

detecting the peak of the fifth signal to determine the time-shift required to align the received signal.

27. The machine-readable medium of claim 26 further comprising:

generating an index based on the location of the detected peak, the index corresponding to the amount by which to time-shift the received signal to synchronize it.

28. The machine-readable medium of claim 26 wherein the magnitude of the peak indicates the direction of the time-shift required to align the received signal.

29. A device for aligning a received signal comprising:

a windowing module to perform a windowing function on the received signal to produce a symbol sample therefrom;

a multiply module communicatively coupled to the windowing module to receive the symbol sample and multiply the symbol sample to a reference synchronization symbol in the frequency domain to produce a first signal therefrom;

a sign detector module communicatively coupled to the multiply module to receive the first signal, determine the sign of the first signal, and produce a second signal therefrom; and

a Fourier transform module communicatively coupled to the sign detector module to receive the second signal, perform a Fourier transform on the second signal, and produce a third signal therefrom containing time-shift information to align the received signal.

30. The device of claim 29 wherein the length of the symbol sample is equal to the length of the reference synchronization symbol.

31. The device of claim 30 wherein the windowing module is capable of performing a Hanning windowing function.

32. The device of claim 29 wherein the first signal produced by the multiply module has real and imaginary components.

33. The device of claim 32 wherein the sign detector module determines the sign of the real and imaginary components of the first signal, and produces two corresponding signal components which comprise a fourth signal.

34. The device of claim 33 further comprising:

a convolution module communicatively coupled to the sign detector module to receive the fourth signal

components and convolved them to produce the second signal.

35. The device of claim 29 wherein the Fourier transform module is capable of performing fast Fourier transforms.

36. The device of claim 29 further comprising:

a second Fourier transform module communicatively coupled to receive the second signal from the sign extractor module, perform a Fourier transform on the symbol sample to transform the symbol sample from the time domain to the frequency domain before it is multiplied to the reference synchronization symbol.

37. The device of claim 36 wherein the third signal produced by the second Fourier transform module comprises real and imaginary components.

38. The device of claim 37 further comprising:

an adding component communicatively coupled to the second Fourier transform module to receive the third signal, add the real and imaginary components of the third signal and produce a fifth signal.

39. The device of claim 38 further comprising:

a peak detector to detect the peak of the fifth signal and determine the time-shift required to align the received signal.

40. The device of claim 39 further comprising:

a controller communicatively coupled to the peak detector to received the received signal according to the time-shift indicated by the fifth signal.

41. A system for aligning a received signal comprising:

means for windowing the received signal to produce a symbol sample;

means for multiplying the symbol sample and a reference synchronization symbol in the frequency domain to produce a first signal;

means for determining the sign of the first signal to produce a second signal; and

means for performing a Fourier transform on the second signal to produce a third signal containing time-shift information to align the received signal.

42. The system of claim 41 wherein the length of the symbol sample is equal to the length of the reference synchronization symbol.

43. The system of claim 42 wherein the windowing is accomplished by a Hanning windowing function.

44. The system of claim 41 further comprising:

means for performing a Fourier transform on the symbol sample to transform the symbol sample from the time domain to the frequency domain before it is multiplied with the reference synchronization symbol.

45. The system of claim 41 further comprising:

means for detecting the peak of the third signal to determine the time-shift required to align the received signal.

46. The system of claim 41 further comprising:

means for aligning the received signal according to the time-shift indicated by the third signal.